University of Bahrain

College of Information Technology
Department of Computer Science

ITCS252 Discrete Structure I

Second Semester 2013/2014
Exam #2 — One Hour

NAME	[redacted]
ID #	[redacted]
SECTION #	[redacted]
SERIAL	[redacted]

Time: 2:00 – 3:00 PM

This exam contains **4** pages (including this cover page) and **6** questions. Check to see if any pages are missing. Enter all requested information.

You are not allowed to use books, notes, or mobiles

Question	Points	Score
1	8	6
2	6	6
3	6	6
4	8	7
5	6	6
6	6	6
Total:	40	37

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Question	Points	Score
1	8	4
2	8	5.5
3	8	6.75
4	10	10
Total:	34	26.25

(1) [8 points] Answer the following questions.

(a) Give a counter example to: $\forall m, n$: if both m and n are distinct primes, then $m + n$ is prime.

$m = 5$, $n = 3$

2 $\therefore m + n = 5 + 3 = 8 \Rightarrow 8$ is not prime

(b) Give a counter example to: if n is prefect square, then $n + 4$ is prefect square.

$n = 9 = (3)^2$

2 $n + 4 = 9 + 4 = 13 \Rightarrow 13$ is not a perfect square.

(c) *The product of two even integers is composite.* Write the

Hypothesis = n, m are even integers

2 Conclusion= The product of n and m $(n \cdot m)$ is composite

(d) True or False, Explain. $\forall n_{\in \mathbb{Z}}$: $\sqrt{-3n^2 - n(6 - 4n) + 9}$ is rational

False ; counter example , let $n = 1$

$\sqrt{-3(1)^2 - 1(6 - 4(1)) + 9} = \sqrt{2}$

0 $\sqrt{2}$ is irrational

$n = 1 \Rightarrow -3 - (6-2) + 9 = -5 + 9 = 4$.

(2) [6 points] Show that the difference of the squares of two consecutive integers is odd.

Direct proof. Assume there is two consecutive integers n and m.

by definition $n = k$, $m = k + 1$, $k \in \mathbb{Z}$

by substitution

$m^2 - n^2 = (k+1)^2 - k^2 = k^2 + 2k + 1 - k^2$

$= 2k + 1$, $k \in \mathbb{Z}$

6 $\therefore$ odd #

(3) [6 points] Show by contradiction that *for any integer n: if* $n > 0$, *then* $\frac{n}{n+1} > \frac{n}{n+2}$

Suppose not. Suppose there exists an integer n such that $n > 0$ and $\frac{n}{n+1} \le \frac{n}{n+2}$

$n(n+2) \le n(n+1)$

$n^2 + 2n \le n^2 + n$

6

$\cancel{n^2} - \cancel{n^2} + 2n - n \le 0$

$n \le 0$ (contradiction with $n > 0$)

(4) [8 points] Let $U = \{x \in Z^+ \mid -5 \le x \le 5\}$, $A = \{1, 2\}$, $B = \{1, 2, 5\}$ and $C = \{1, 3, 5\}$. Answer the following questions. Show your work.

(a) Find $\overline{(A \cap C) \cup B}$

$= \overline{(\{1,2\} \cap \{1,3,5\}) \cup \{1,2,5\}}$

$= \overline{\{1\} \cup \{1,2,5\}} = \overline{\{1,2,5\}}$

$= \{-5,-4,-3,-2,-1,0,3,4\}$

(b) Find $P(A) \cap P(B - C)$

$P(A) = \{\emptyset, \{1\}, \{2\}, \{1,2\}\}$

$P(B-C) = \{\emptyset, \{2\}\}$

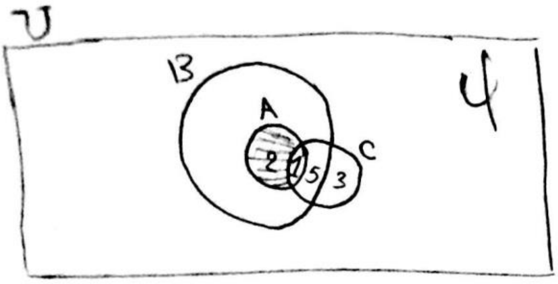
$P(A) \cap P(B-C) = \{\emptyset, \{2\}\}$

(c) Find $|P(A - B) \cup P(B - A)|$

$= |P(\emptyset) \cup P(\{5\})| = |P(\{5\})| = 2^1 = 2$

How

(d) Draw Venn Diagram for $(A \cap B) - C$. Show all numbers of the U set in the Diagram.



(5) [6 points] show that $(C - D) \cup (C \cap D) \subseteq C$

let $x \in (C-D) \cup (C \cap D)$

$\therefore x \in (C-D)$ or $x \in (C \cap D)$

Case 1: $x \in (C-D)$

$x \in (C \cap \bar{D})$

$\therefore x \in C$ and $x \notin D$ $\Rightarrow \therefore x \in C$

Case 2: $x \in (C \cap D)$

$\therefore x \in C$ and $x \in D$

$x \in D$ is rejected because [illegible] $\Rightarrow \therefore x \in C$

(6) [6 points] Show that $(A - B) \cup (A - C) = A - (B \cap C)$

R.H.S $= A - (B \cap C)$

$= A \cap \overline{(B \cap C)}$

$= A \cap (\bar{B} \cup \bar{C}) = (A \cap \bar{B}) \cup (A \cap \bar{C})$

$= (A - B) \cup (A - C) =$ L.HS